

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-045071

(43)Date of publication of application : 16.02.1999

(51)Int.Cl. G09G 3/30
 G09G 3/20
 G09G 3/20
 // H05B 33/08

(21)Application number : 10-144218

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(22)Date of filing : 26.05.1998

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(30)Priority

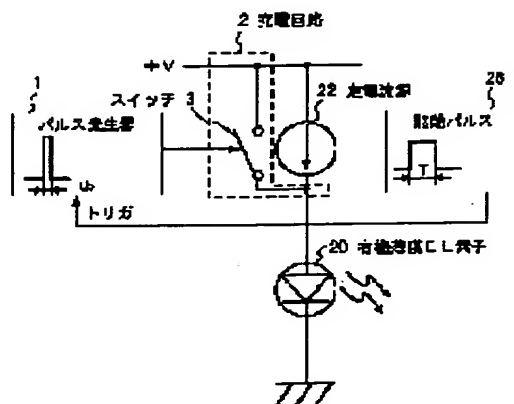
Priority number : 09139984 Priority date : 29.05.1997 Priority country : JP

(54) DRIVING METHOD OF ORGANIC THIN FILM EL ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent brightness from decreasing even if a capacitive element is driven and to extend a life of an organic thin film EL element by charging a junction capacitor of the organic thin film EL element upto a specified potential by an pulse output synchronizing with an output of a current driving means.

SOLUTION: A charging circuit 2 has a switching element 3. A pulse generator 1 is triggered by a drive pulse 26, outputs a pulse of a period t_b very short compared with the drive pulse period T , and brings the switching element 3 into conduction. When the switching element 3 is brought into conduction, a power source voltage $+V$ is directly impressed on the organic thin film EL element 20. Then, a current limited by a constant current source 22 is made to flow through the organic thin film EL element 20 in a state released from the current limit, and quickly charges a junction capacitor portion of the organic thin film EL element 20. On-period t_b of the switching element 3 is set beforehand at a period long enough to charge the junction capacitor portion of organic thin film EL element 20.



LEGAL STATUS

[Date of request for examination] 26.05.1998

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3102411

[Date of registration] 25.08.2000

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] In the drive circuit of the organic thin film EL element for carrying out the matrix drive of two or more organic thin film EL elements in which at least one side which pinches an organic thin film luminous layer contains a transparent signal electrode and a scan electrode The current driving means which supplies a constant current driving signal to said signal electrode according to an input signal, The drive circuit of the organic thin film EL element characterized by having the pulse generator which outputs the pulse which synchronized with the output of said current driving means, and the charge circuit which charges the junction capacitance of said organic thin film EL element with the output of said pulse generator at predetermined potential.

[Claim 2] Said charge circuit is a drive circuit of the organic thin film EL element according to claim 1 which it has a switching element, and said switching element is operated with the output of said pulse generator, and is characterized by being the configuration of charging said organic thin film EL element at predetermined potential with the time constant which becomes settled with the on resistance of said switching element, and the junction capacitance of said organic thin film EL element.

[Claim 3] The charging time by said charge circuit is the drive circuit of the organic thin film EL element according to claim 1 characterized by being shorter than the pulse output time amount of said current driving means.

[Claim 4] In the drive circuit of the organic thin film EL element for carrying out the matrix drive of two or more organic thin film EL elements in which at least one side which pinches the luminous layer which consists of the organic substance, and its luminous layer contains a transparent signal electrode and a scan electrode The current driving means which supplies a constant current driving signal to said signal electrode according to an input signal, The pulse generator which outputs the pulse which synchronized with the output of said current driving means, It has the charge circuit which charges the junction capacitance of said organic thin film EL element with the output of said pulse generator at predetermined potential. The drive circuit of the organic thin film EL element characterized by establishing the period which discharges the charge charged by said organic thin film EL element between the driving pulses of the following scan electrode in the driving pulse which drives the scan electrode of 1 of said arbitration.

[Claim 5] The period which discharges said charge is the drive circuit of the organic thin film EL element according to claim 4 characterized by being a period between that to which predetermined carried out period compaction of the driving pulse which drives the scan electrode of 1 of said arbitration, and the driving pulse of the following scan electrode.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the drive circuit of the organic thin film EL used in case the matrix drive of the EL element is carried out and an alphabetic character and a graphic form are especially displayed about the drive circuit of the organic thin film EL element using the electroluminescence (EL) phenomenon of an organic thin film.

[0002]

[Description of the Prior Art] If a certain kind of organic thin film is put and energized with each electrode of an anode plate and cathode, the electron hole and electron which were poured in from each electrode recombine within an organic thin film, and it is known that luminescence will arise with the energy at that time. this phenomenon is called the organic thin film EL — having — several V — about ten — even if it can drive with about V direct current voltage and being compared with other display devices, luminous efficiency is high, and a body is thin and research is prosperous also in an advantage, such as being light, towards the application to various luminescence devices from a certain thing.

[0003] Although it is generated even if the organic thin film (it is hereafter described as an organic luminescence thin film layer) which may emit light is a monolayer, this EL phenomenon needs to raise the injection efficiency of the carrier from each electrode to an organic luminescence thin film layer, in order to obtain high brightness with lower applied voltage. Therefore, the energy barrier height between an electrode and an organic luminescence thin film layer is reduced, and the laminated structure which added the carrier impregnation layer or the carrier transportation layer between the electrode and the organic luminescence thin film layer for the purpose of making easy carrier migration in an organic luminescence thin film layer is proposed. For example, laminated structures, such as structure of the anode plate / organic electron hole transportation layer / organic luminescence thin film layer / cathode indicated by JP,57-51781,A and structure of an anode plate given in JP,6-314594,A / two or more organic hole-injection transportation layers / organic luminescence thin film layers / two or more organic electron injection transportation layers / cathode, are mentioned. In addition, the order of a laminating may be the reverse of these examples. The cross section of a general laminated-structure organic thin film EL element which becomes drawing 5 from the anode plate / organic electron hole transportation layer / organic luminescence thin film layer / cathode formed on the support substrate, and the approach of the electrical-potential-difference impression to a component are shown.

[0004] the convenience top whose electrode must take out the light from an organic luminescence thin film layer first as an ingredient which constitutes the illustrated organic thin film EL element with reference to drawing 5 — at least — shade and a positive — one of electrodes need to have translucency. As for many, the thin film of the film metallurgy of an indium and a tin oxide (ITO) etc. is used for the anode plate 31. On the other hand, the small ingredient of a work function is chosen as cathode 34 from the purpose which makes electronic impregnation obstruction height low, and metal membranes, such as magnesium, aluminum, and an indium, or the alloy film of these metals is used for it.

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TECHNICAL FIELD

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[Translation done.]

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PRIOR ART

[Description of the Prior Art] If a certain kind of organic thin film is put and energized with each electrode of an anode plate and cathode, the electron hole and electron which were poured in from each electrode recombine within an organic thin film, and it is known that luminescence will arise with the energy at that time. this phenomenon is called the organic thin film EL — having — severalV—about ten — even if it can drive with about V direct current voltage and being compared with other display devices, luminous efficiency is high, and a body is thin and research is prosperous also in an advantage, such as being light, towards the application to various luminescence devices from a certain thing.

[0003] Although it is generated even if the organic thin film (it is hereafter described as an organic luminescence thin film layer) which may emit light is a monolayer, this EL phenomenon needs to raise the injection efficiency of the carrier from each electrode to an organic luminescence thin film layer, in order to obtain high brightness with lower applied voltage. Therefore, the energy barrier height between an electrode and an organic luminescence thin film layer is reduced, and the laminated structure which added the carrier impregnation layer or the carrier transportation layer between the electrode and the organic luminescence thin film layer for the purpose of making easy carrier migration in an organic luminescence thin film layer is proposed. For example, laminated structures, such as structure of the anode plate / organic electron hole transportation layer / organic luminescence thin film layer / cathode indicated by JP,57-51781,A and structure of an anode plate given in JP,6-314594,A / two or more organic hole-injection transportation layers / organic luminescence thin film layers / two or more organic electron injection transportation layers / cathode, are mentioned. In addition, the order of a laminating may be the reverse of these examples. The cross section of a general laminated-structure organic thin film EL element which becomes drawing 5 from the anode plate / organic electron hole transportation layer / organic luminescence thin film layer / cathode formed on the support substrate, and the approach of the electrical-potential-difference impression to a component are shown.

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EFFECT OF THE INVENTION

[Effect of the Invention] As more than explained, this invention has established the charge circuit which charges an EL element with the output of a pulse generator at predetermined potential at the time of the drive start of an EL element to the drive circuit of an organic thin film EL element in the current driving means which supplies the constant current driving signal which drives an EL element.

[0038] Moreover, when not following the case [that the effectiveness of a charge circuit is large] where elapsed and the EL element is continuously on, according to the contents of the screen and brightness differs, pulse width of a scan side pulse is made shorter than one scan period.

[0039] When carrying out a constant current drive by the square wave-like pulse signal at a signal electrode according to an input signal by this according to this invention, the fall of brightness can be controlled even if an EL element is capacitive. It is because it can drive without being able to charge the junction capacitance of an EL element by very short time amount, and delaying the start of a pulse.

[0040] Moreover, according to this invention, the life of an EL element can be prolonged. It is because it is not necessary to obtain required brightness while the start of a driving pulse has been late, and it is not necessary to pass many currents utterly and the useless temperature rise of an EL element is suppressed.

[0041] Furthermore, it is because charging beyond the need will be lost when the time amount which an EL element turns on becomes short, a crevice is vacant little by little in a driving pulse and it charges in the charge circuit of this invention if the period of a scan pulse becomes short.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the flat-surface luminescence mold organic thin film EL display of the conventional example 1, although the 1st problem in the Prior art mentioned above supplies the constant current driving signal to the signal electrode according to an input signal, when it drives by the square wave-like pulse signal at this time, it is a problem that the start of a pulse is overdue and brightness does not go up. It is because it will shift to luminescence actuation after charging capacity first if it drives with a fixed current, since an organic thin film EL element has a junction capacitance, so it takes time amount that an electrical potential difference goes up to luminescence initiation.

[0014] In order to give explanation brief and to make an understanding easy, when it extracts by 1 pixel and expresses from the circuit diagram shown in drawing 7, the conventional example 1 will be driven with the configuration as shows organic thin film EL element 20 to drawing 9. Here, if an organic EL device 20 is driven by the square wave-like pulse signal 26, the pulse voltage shown by OAPQ in the voltage waveform shown in drawing 10 will be impressed to EL element 20. In drawing 10, the electrical potential difference VF in an axis of ordinate is the forward voltage of an EL element, and an electrical potential difference Va is an electrical potential difference on which an EL element starts luminescence. Since it begins to drive the time amount ta in an axis of abscissa by the pulse, it is time amount until it starts luminescence. Moreover, time amount T is time amount which is impressing the driving pulse to an EL element, for example, T is set to about 104 microseconds if it drives on 1/64 duty and the repeat frequency of 150Hz by dynamic lighting.

[0015]

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MEANS

[Means for Solving the Problem] In the drive circuit of an organic thin film EL element for the drive circuit of the organic thin film EL element of this invention to carry out the matrix drive of two or more organic thin film EL elements in which at least one side which pinches the luminous layer which consists of the organic substance, and its luminous layer contains a transparent signal electrode and a scan electrode With the output of the current driving means which supplies a constant current driving signal to said signal electrode according to an input signal, the pulse generator which outputs the pulse which synchronized with the output of said current driving means, and said pulse generator It is characterized by having the charge circuit which charges the junction capacitance of said organic thin film EL element at predetermined potential.

[0020] The drive circuit of the organic thin film EL element of this invention established the charge circuit which charges an EL element with the output of a pulse generator at predetermined potential at the time of the drive start of an EL element in the current driving means which supplies the constant current driving signal which drives an EL element. For this reason, the drive start of an EL element can be carried out early, and it can prevent that brightness falls also in a capacitive component.

[0021]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained with reference to a drawing. Basic actuation of the gestalt of operation of the 1st of introduction and this invention is explained.

Drawing 1 is the block diagram showing the principle of operation of this invention, and extracts 1 pixel among the circuits which drive a matrix-like component. With reference to drawing 1, the charge circuit 2 has the switching element 3.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] It is the block diagram for 1 pixel of the gestalt of operation of the 1st of this invention.
- [Drawing 2] It is drawing showing the pulse shape in the gestalt of the 1st operation.
- [Drawing 3] It is the block diagram for 1 pixel of the gestalt of operation of the 2nd of this invention.
- [Drawing 4] It is the circuit diagram of the transistor level for 1 pixel of the gestalt of the 2nd operation.
- [Drawing 5] It is drawing showing the structure and the electrical-potential-difference impression approach of an example of an organic thin film EL element.
- [Drawing 6] It is drawing showing an example of the current-voltage characteristic of an organic thin film EL element.
- [Drawing 7] It is the circuit diagram of the drive circuit of the display of the conventional example 1.
- [Drawing 8] It is drawing showing the pulse drive wave of the EL element of the conventional example 2.
- [Drawing 9] It is the block diagram for 1 pixel of the conventional example 1.
- [Drawing 10] It is drawing showing the pulse shape in the conventional example 1.
- [Drawing 11] It is drawing showing the circuitry of the display of the conventional example 1.
- [Drawing 12] It is drawing showing the timing chart of the indicating equipment of the conventional example 1.
- [Drawing 13] It is drawing showing the whole drive circuit configuration of the gestalt of operation of this invention.
- [Drawing 14] It is drawing showing the timing chart of the conventional drive circuit.
- [Drawing 15] It is drawing showing the timing chart of the drive circuit of the gestalt of operation of the 2nd of this invention.
- [Drawing 16] It is drawing showing the timing chart of the drive circuit of this invention.
- [Drawing 17] It is drawing showing the timing chart of the drive circuit of the gestalt of operation of the 3rd of this invention.
- [Drawing 18] It is drawing explaining a part of drive circuit of the gestalt of operation of the 3rd of this invention.

[Description of Notations]

- 1 Pulse Generator
- 2 Charge Circuit
- 3 Switching Element
- 4 Current Modulation Circuit
- 5 Switching Element
- 6 Inverter
- 20 Organic Thin Film EL Element
- 22 Constant Current Source
- 26 Driving Pulse
- 30 Display Panel
- 32 X Driver
- 34 Y Driver
- 36 A/D Converter
- 38 Shift Register (Memory)
- 42 Controller
- 44 Flip-flop
- 46 Flip-flop
- 48 PWM Modulator
- 50 Flip-flop
- 52 Light Emitting Device
- 60 X Driver
- 61 Y Driver
- 62 EL Panel
- 64 Data Generator
- 65 Timing Generator
- 66 Constant Current Mechanical Component
- 90 91 Transistor
- 92 Transistor

93, 94, 95 Resistance

[Translation done.]

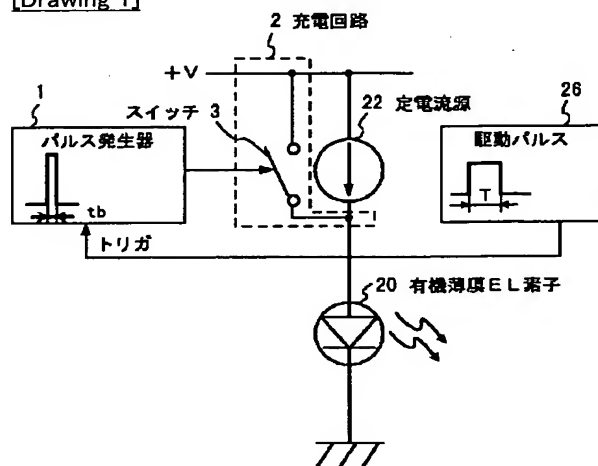
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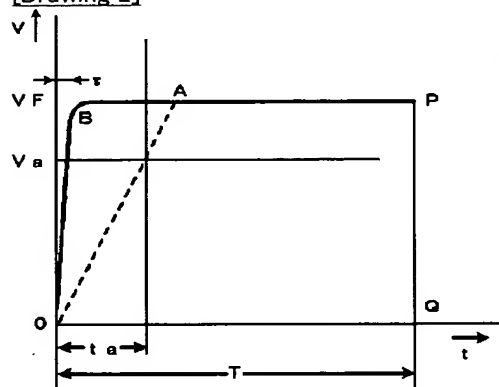
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DRAWINGS

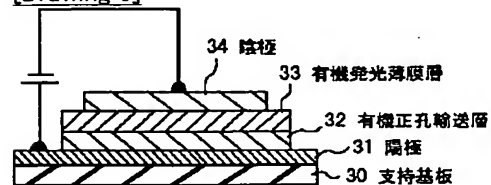
[Drawing 1]



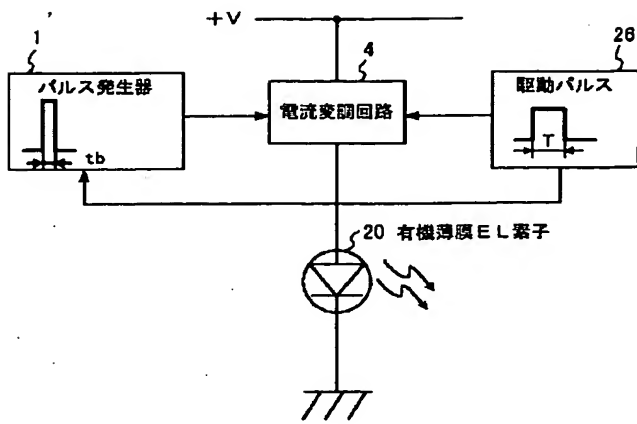
[Drawing 2]



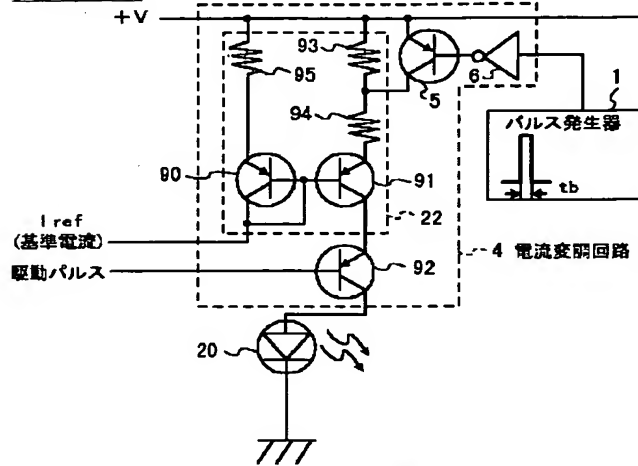
[Drawing 5]



[Drawing 3]



[Drawing 4]

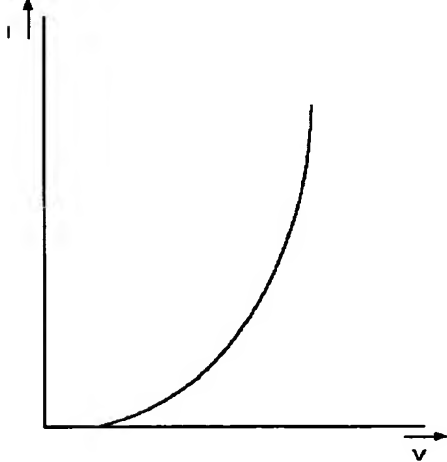


5: スイッチング素子

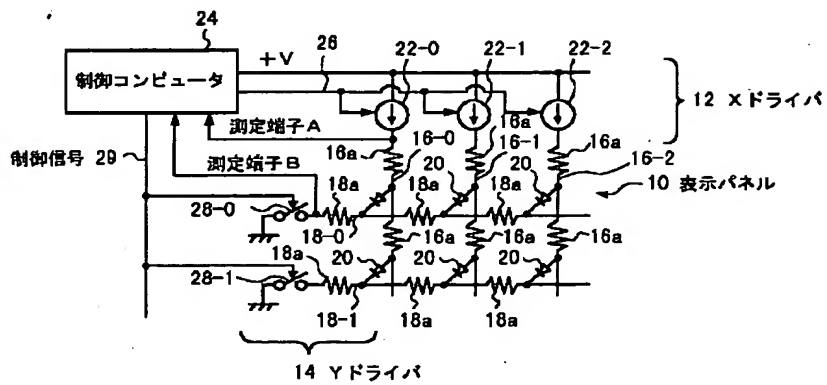
22: 定電流源

6: インバータ

[Drawing 6]



[Drawing 7]



16-0, 16-1, 16-2 : 信号電極

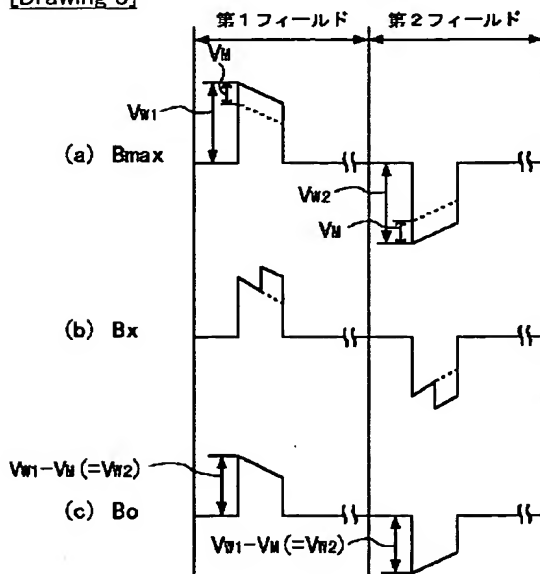
18-0, 18-1 : 走査電極

20 : 発光素子

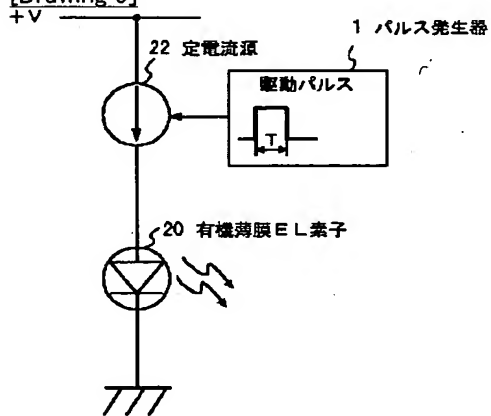
22-0, 22-1, 22-2 : 定電流源

26 : 駆動パルス

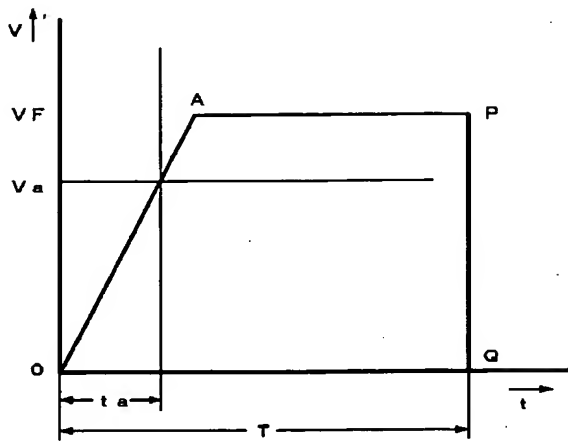
[Drawing 8]



[Drawing 9]

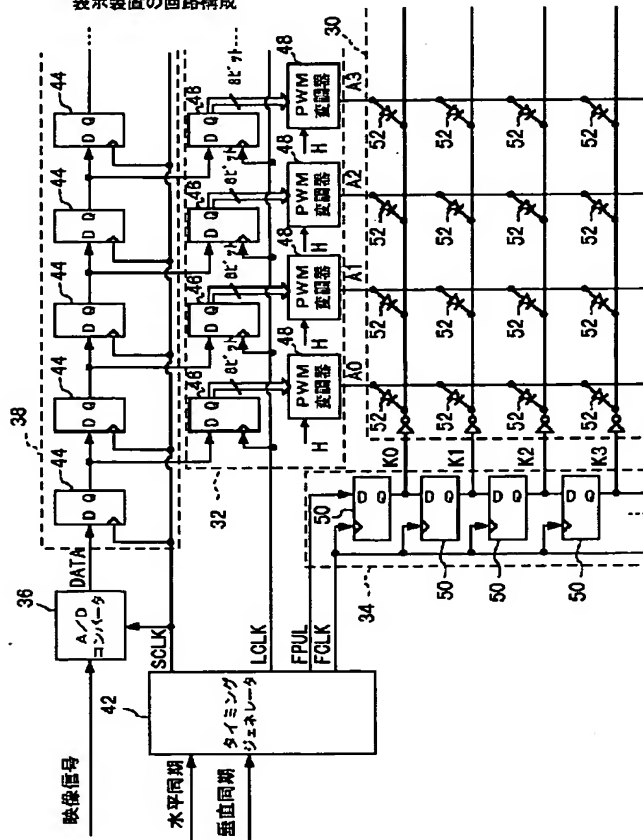


[Drawing 10]



[Drawing 11]

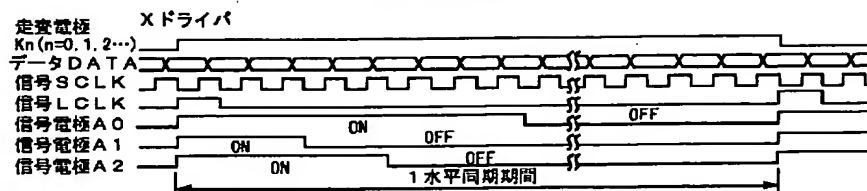
表示装置の回路構成



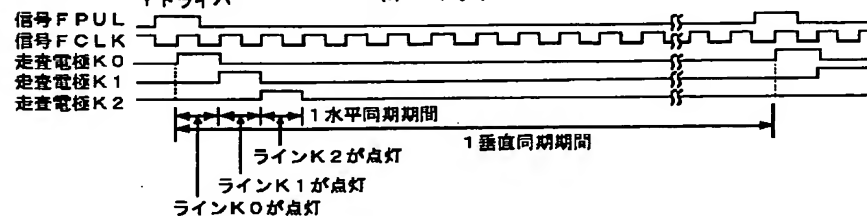
[Drawing 12]

表示装置のタイミングチャート

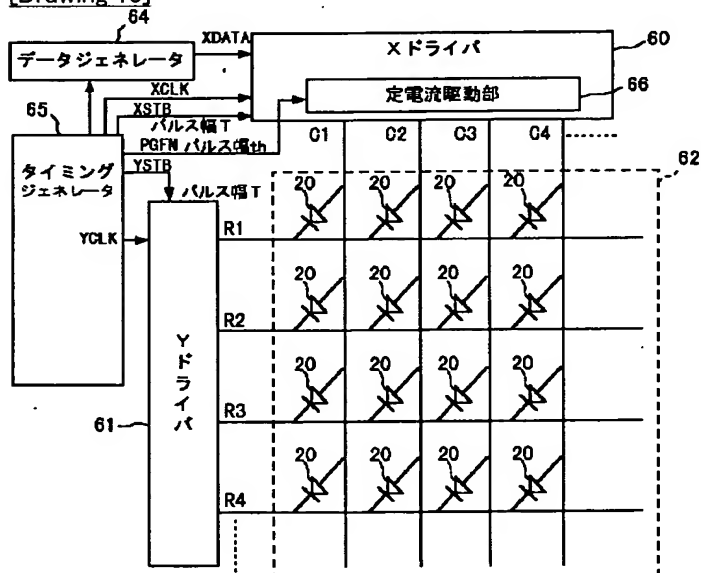
(A) Xドライブ



(B) Yドライブ

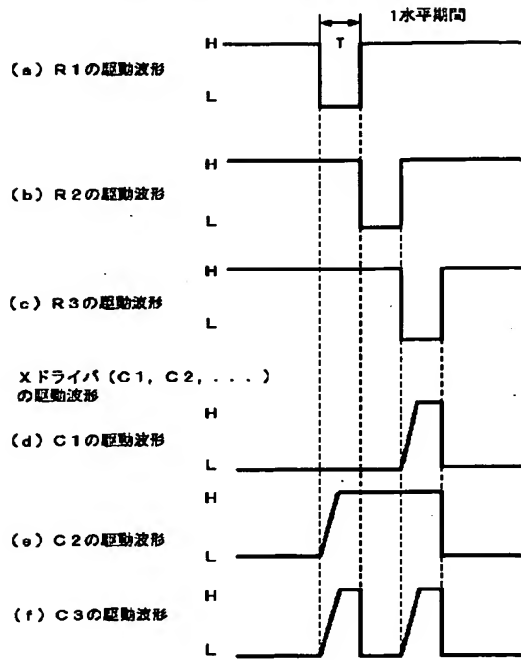


[Drawing 13]



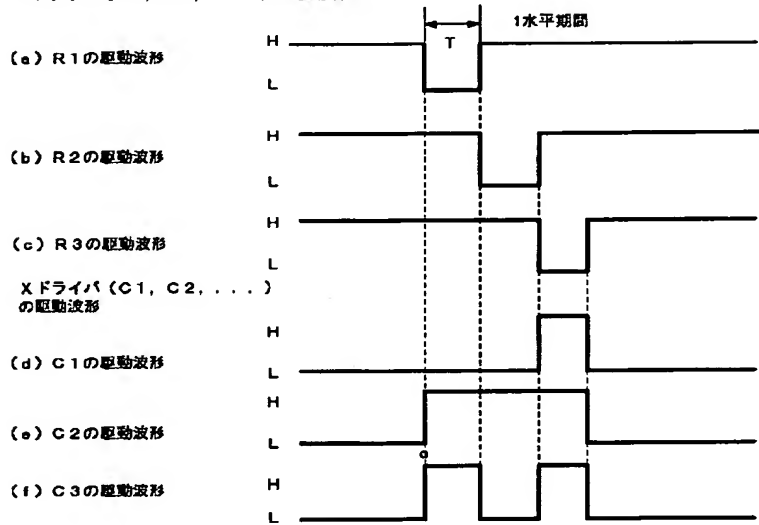
[Drawing 14]

Yドライバ(R1, R2, ...)の駆動波形

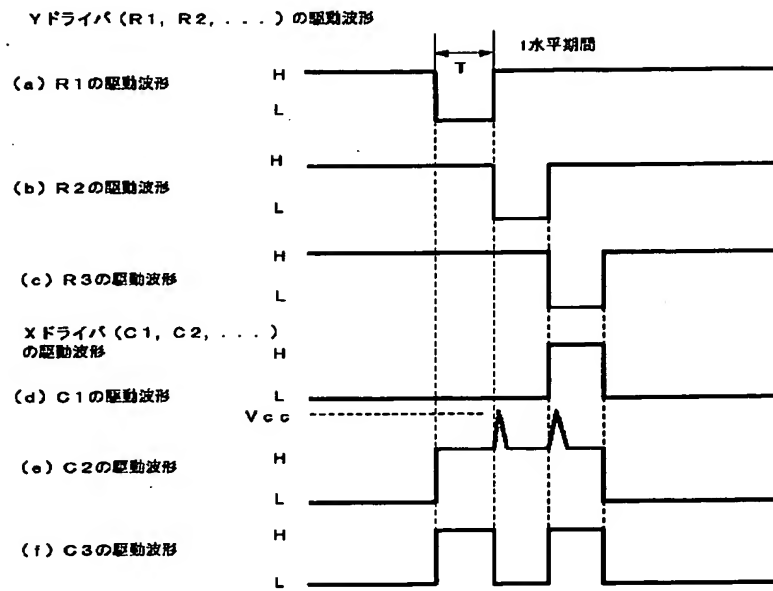


[Drawing 15]

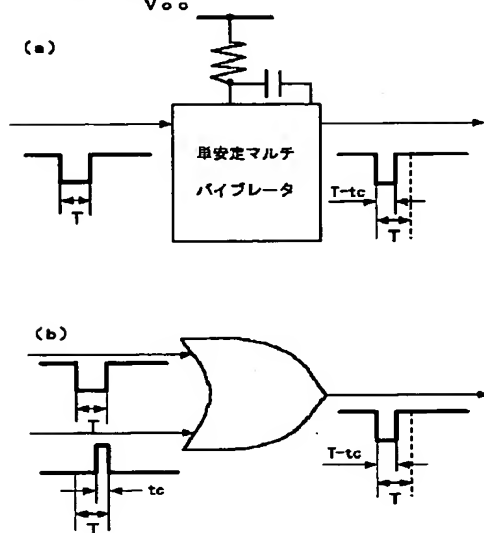
Yドライバ(R1, R2, ...)の駆動波形



[Drawing 16]

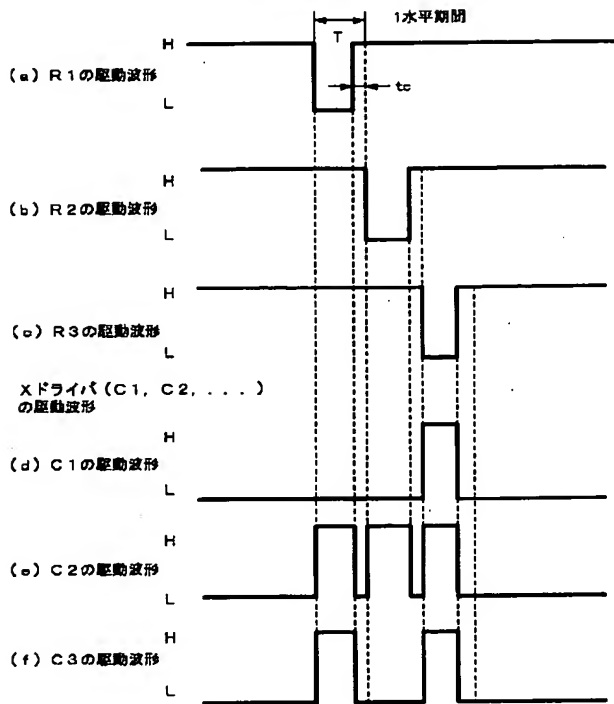


[Drawing 18]



[Drawing 17]

Yドライバ (R1, R2, ...) の駆動波形



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